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## (54) Quality of service on demand for voice communications over a packet data network

(57) A method is presented for efficiently utilizing network resources while routing voice communications over a packet-based data network with specified minimum quality of service requirements, where greater network resources are required to ensure higher quality of service parameters. A dial code can be entered by a user to specify an appropriate quality of service. If the dial code is valid, the call is routed with the specified quality of service. If the dial code is not valid, the call is routed with default minimum quality of service parameters. Also, a line may be associated with overriding minimum quality of service parameters, whereby all calls directed to such a line are automatically upgraded, if necessary, to conform to the overriding minimum quality of service

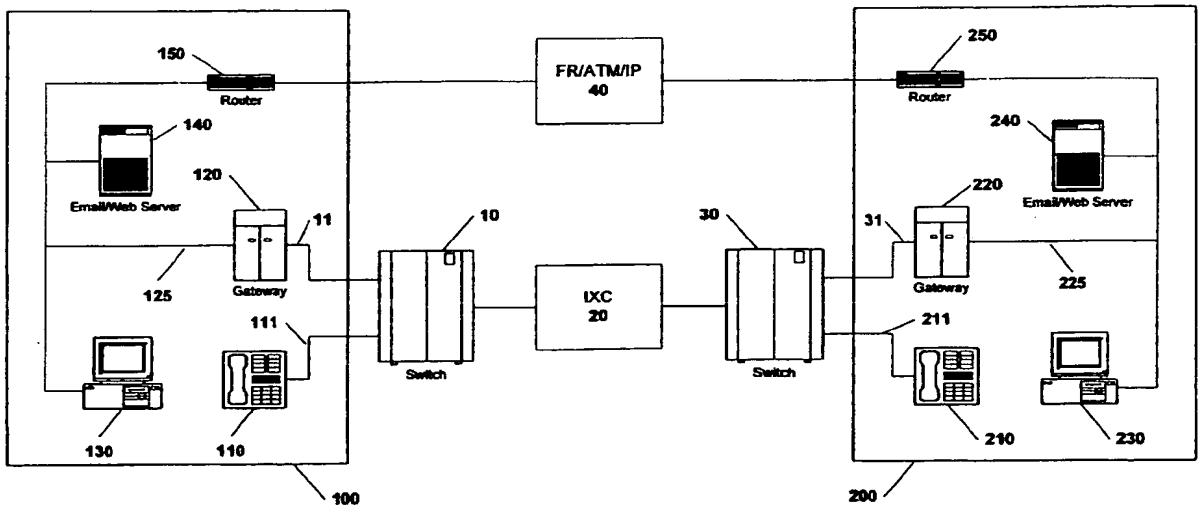


Figure 1

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authorized, specify a QOS guarantee different from any default line value that is appropriate for a particular call.

**[0011]** Finally, some call recipients may require or desire a predetermined minimum QOS guarantee for calls received, regardless of the line originating the call. For example, a voice mail system with touch-tone menu operation may have a specific QOS level that is required for reliable digit recognition. Therefore, it would be desirable if all calls placed to such a voice mail system were automatically assigned a predetermined minimum QOS guarantee that is known to allow for reliable digit and/or voice recognition. Accordingly, it is an object of this invention to provide a destination line override feature, whereby a call's QOS can be automatically adjusted to guarantee predetermined QOS parameters corresponding to the line receiving the call.

## Summary Of The Invention

**[0012]** The invention provides for the efficient allocation of network resources, when a packet network is utilized to route QOS-sensitive communications, such as voice, with specified quality of service parameters. Default quality of service parameters are assigned to a first telephone line on which a call is initiated. A dial code can then be received on the first telephone line. The dial code may include a security or personal identification sequence to restrict the specification of QOS parameters to desired users, and/or to log the use of specified QOS parameters. The dial code may also include a sequence which specifies one of a plurality of available quality of service levels.

**[0013]** A call is placed on the first line, directed to a second line. The applicable quality of service parameters for the call are then determined. If the QOS request code is valid, then the call is routed over the packet network with guaranteed quality of service parameters corresponding to the requested quality of service level. If the QOS request code is not valid, then the call is routed over the packet network with guaranteed quality of service parameters corresponding to the default quality of service level for the first telephone line. If sufficient network resources are not available to guarantee the requested quality of service level, the caller can choose to route the call at a lower quality of service level, or hold until the desired quality of service level becomes available.

**[0014]** Furthermore, a telephone line can be assigned override quality of service parameters, so that QOS-sensitive telephone users, such as voice mail systems that employ touch tone or voice recognition or individuals who demand high QOS, can ensure that all calls placed to them satisfy the override quality of service parameters. A call is initiated from a first telephone line, directed to a second telephone line, according to the quality of service level corresponding to the first line. The communications system determines that one or more of the first line quality of service parameters with which the call was initiated is of lesser quality that the level specified by the override parameters. The call is then routed between the first and second telephone lines with quality of service parameters equal to or better than the override quality of service parameters.

## Brief Description Of The Drawings

**[0015]** Figure 1 is a block diagram of an embodiment of the invention involving two local area networks, between which telephone calls can be placed over an interconnecting packet network link.

**[0016]** Figure 2 is a block diagram of another embodiment of the invention, with which all calls placed to a voice mail system over a packet network satisfy predetermined minimum QOS parameters.

## Detailed Description Of The Drawings

**[0017]** While this invention is susceptible to embodiment in many different forms, there are shown in the drawings and will be described in detail herein several specific embodiments. The present disclosure is to be considered as an exemplification of the principle of the invention intended merely to explain and illustrate the invention, and is not intended to limit the invention in any way to embodiments illustrated. For example, while the specific embodiments of Figures 1 and 2 specifically involve telephonic voice communications, it is envisioned that other forms, including facsimile and data communications, are within the scope of this invention.

**[0018]** Figure 1 depicts an embodiment of the invention that includes corporate office 100 and corporate office 200, the offices being interconnected by both circuit-switched telephone interexchange carrier 20, and packet-based network connection 40. Furthermore, corporate office 100 includes IP-based local area network 125, and office 200 includes IP-based local area network 225. In embodiments such as those of Figure 1, in which multiple corporate offices are interconnected, packet-based network 40 will typically consist of a frame relay link, an asynchronous transfer mode ("ATM") link, or a high-speed IP link, such as a dedicated T1 line.

**[0019]** Under a conventional, switched circuit telephone system, if a user of telephone 110 places a call to telephone 210, the user dials the telephone number corresponding to line 211 onto telephone line 111, which may be comprised of a communications link such as an analog telephone line, an ISDN digital line or a wireless datalink. Local switching service point 10 receives the dialing, and routes the call onto interexchange carrier 20. The call is routed through interexchange carrier 20 to switching service point 30, which is the local switching service point for telephone line 210. Switch 30 then routes the call to telephone line 211, to which telephone 210 is connected. Under this conventional scenario, the owner of telephone line 111 pays an access fee to the operator of interexchange carrier 20.

be known to one of skill in the art, many dial code formats could be utilized to signify the desired QOS for a given call. Moreover, while the above-described embodiment involves the manual entry of a QOS request code, the QOS request code may be transmitted automatically by a preprogrammed call initiating device, and/or transmitted digitally by a device initiating a communication over a digital connection such as an H.323 link.

**[0030]** Switch 10 receives the call and determines that the call should be placed over the packet network. In one embodiment, switch 10 evaluates the QOS request code by comparing the dialed value to stored values within the switch user profile database. If the request code is valid, switch 10 routes the call and the requested QOS requirement to gateway 120. Gateway 120 then proceeds to initiate the call onto packet network 125, with the user's requested QOS parameters, according to the previously described sequence of events, which sequence is known in the art. If the request code is not valid, switch 10 may route the call to gateway 120, with default QOS parameters corresponding to line 111.

**[0031]** In another embodiment, default QOS levels and QOS request codes may be stored in a database within the gateway, instead of in a data base within the switch. In such an embodiment, each call, and any QOS request, is routed from telephone line 111 to gateway 120 through switch 10 and ISDN PRI 11, by techniques known in the art. Then, gateway 120 evaluates the dial code according to a user profile database stored within the gateway. The gateway sets up the call with either the requested QOS parameters if the dial code is valid, or the default QOS parameters for the originating line if the dial code is invalid, according to the previously described method for completing a call guaranteed QOS parameters.

**[0032]** When traffic on the packet network is high, sufficient network resources may not be available to guarantee the requested QOS parameters. In such a circumstance, switch 10 may alert the user of telephone 110 via, for example, a voice announcement, that the requested QOS is not available. The network may then provide a number of call routing options to the user, including the options to route the call at a lower guaranteed QOS level, route the call over a circuit-switched network, or hold until sufficient network resources become available to route the call over the packet network at the requested QOS level.

**[0033]** Another aspect of the invention involves a destination line QOS override feature. With destination line override, the recipient of a call can force higher guaranteed QOS parameters for each call that is received thereto. For example, voice mail systems may require a minimum QOS for accurate and reliable touch tone DTMF digit detection, which is commonly used to navigate and control such systems. Therefore, every call placed to the voice mail system should be placed with the appropriate minimum QOS parameters to permit reliable operation of the system, regardless of the QOS demanded by the originating line. The destination line override feature provides for this. The destination line override feature could also be desirable in applications such as the provision of incentives or benefits for preferred customers by businesses. For example, voice and/or data communications initiated by preferred customers could be prioritized by automatically upgrading the call to a higher quality of service level, while communications initiated by unknown or nonpreferred customers would be completed at a lower level.

**[0034]** Figure 2 depicts an embodiment of a telecommunications system in which the destination override feature can be implemented. Telephone 110 is used to call voice mail system 310 at telephone line 311, which call requires a predetermined minimum QOS for reliable operation of the voice mail system. Switch 10 determines that the call to voice mail system 310 can be routed over the packet network, and connects line 111 via PRI 11 to gateway 120. Switch 10 also conveys the QOS parameters corresponding to line 111 to gateway 120. Gateway 120 then requests the call setup, as previously described, with a guaranteed QOS corresponding to the default QOS of line 111.

**[0035]** However, when the call reaches switch 30, switch 30 determines that its user profile database specifies predetermined minimum QOS parameters for all calls received by line 311. If the QOS with which gateway 120 initiated the call is lower than the line 311 predetermined minimum QOS, then switch 30 initiates the reservation of higher end-to-end guaranteed QOS parameters for the call corresponding to the line 311 predetermined minimum parameters, according to one of the aforementioned techniques known in the art for guaranteeing QOS on a packet-based network. Therefore, each call placed to voice mail system 310 will have at least the minimum QOS required for reliable operation.

**[0036]** As with the dial code QOS request feature, it is contemplated that destination line override QOS parameters could also be stored within a subscriber profile database in the gateway—particularly, gateway 320 in the embodiment of Figure 2. Accordingly, in such an embodiment, gateway 320 determines whether the received call is being set up with QOS parameters sufficient to satisfy the line 311 minimums, and initiates the reservation of sufficient QOS guarantees if the initial parameters are insufficient.

**[0037]** Moreover, the override QOS parameters may also be contingent upon the identity of the calling party. This aspect can be implemented in the embodiment of Figure 2 by identifying the calling party according to techniques known in the communications art. Gateway 320 then determines whether the call is being set up with QOS parameters sufficient to satisfy minimum quality of service levels associated with the identified calling party, and initiates reservation of sufficient QOS guarantees if the initial parameters are insufficient.

**[0038]** The foregoing description and drawings mere-

is valid if it is contained within a list of predetermined valid request codes.

8. The method of claim 2, in which the substep of checking whether the dialed QOS request code is valid is further comprised of the substeps of:

specifying a predetermined formula to which valid request codes must comply;

determining that the dialed QOS request code is valid if it conforms to a predetermined formula.

9. A method for specifying one or more quality of service parameters for a telephone call placed from a first telephone line to a second telephone line, which call is routed over a packet-based network, the method comprising the steps of:

determining a set of override quality of service parameters for use in conjunction with calls directed to the second telephone line;

placing a call on the first telephone line, which call specifies a first set of quality of service parameters and is directed to the second telephone line;

determining that one or more of the first set of quality of service parameters is of a lower quality level than the level specified by the corresponding override quality of service parameters;

10. The method of claim 9, which method further includes the step of routing the call between the first telephone line and the second telephone line via the packet-based network with quality of service parameters at least equal to the override quality of service parameters.

11. The method of claim 9, the method further comprising the steps of:

identifying the telephone line from which the call to the second telephone line is received; determining whether override quality of service parameters should be applied to the call based upon the identification of the telephone line from which the call is received;

routing the call between the first telephone line and the second telephone line via the packet-based network according to the applicable quality of service parameters.

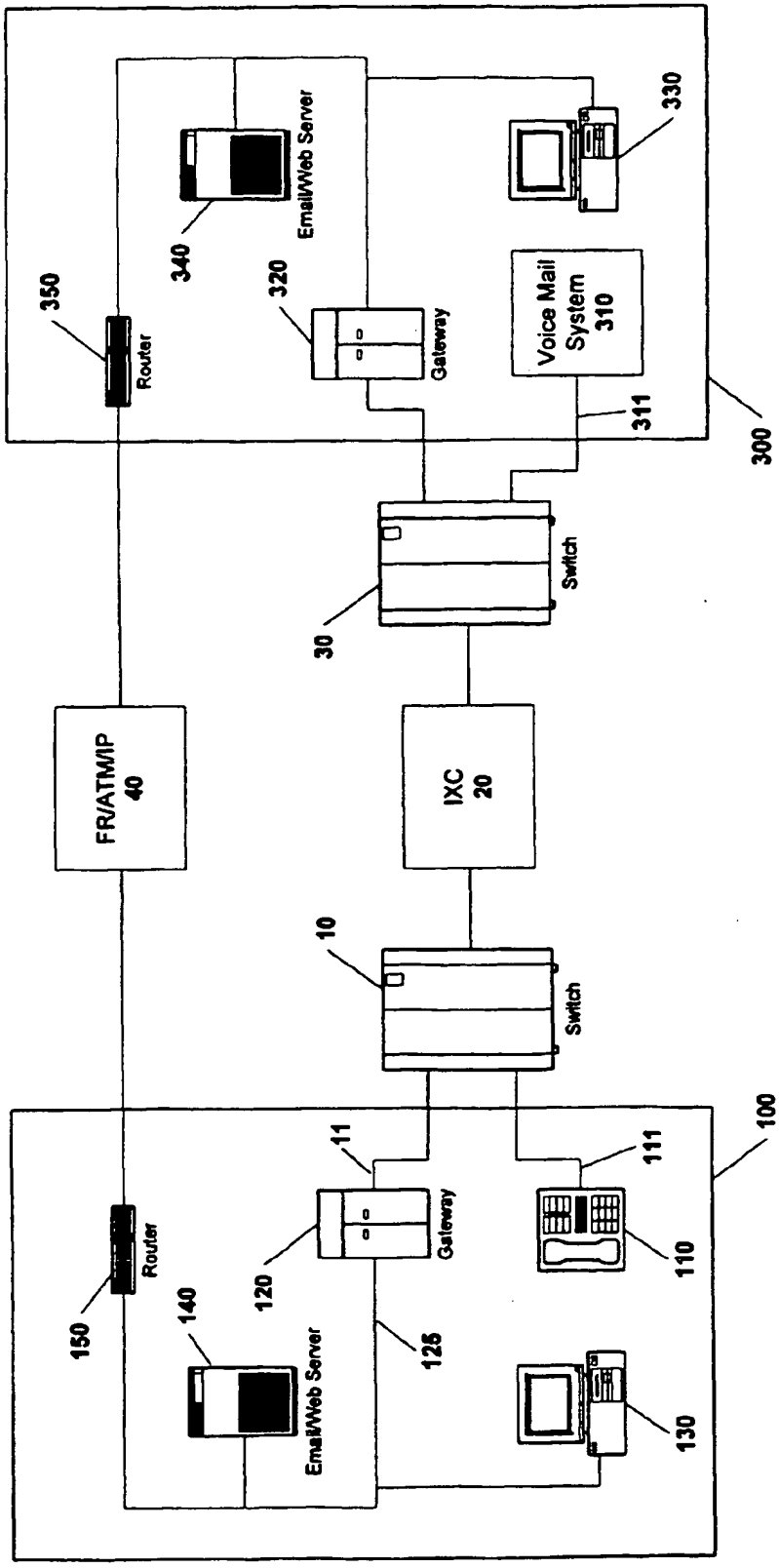


Figure 2

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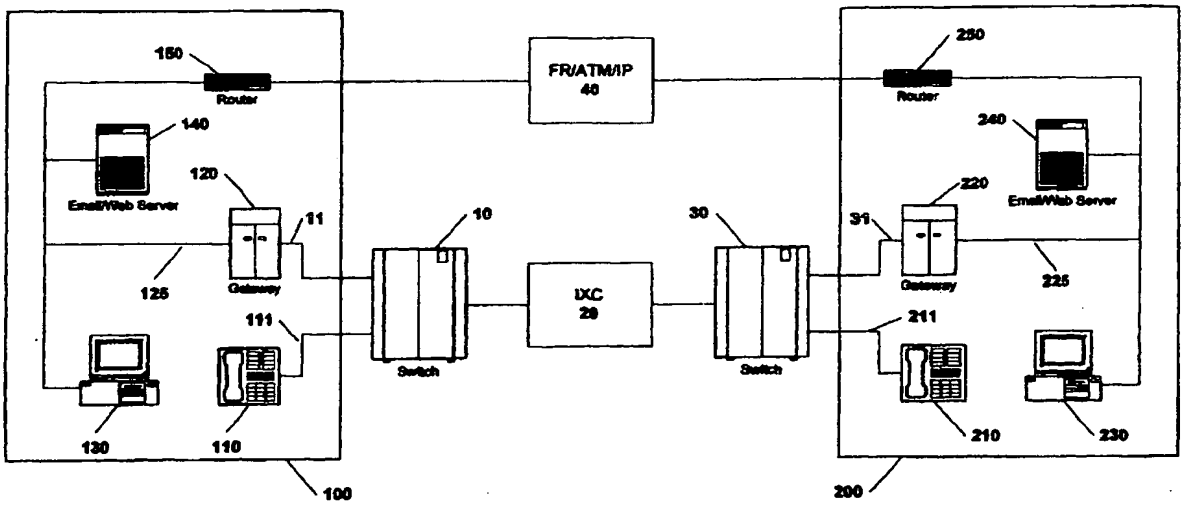


Figure 1

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